

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

To:

Assistant Commissioner for Patents
United States Patent and Trademark
Office
Box PCT
Washington, D.C. 20231
ÉTATS-UNIS D'AMÉRIQUE

in its capacity as elected Office

Date of mailing (day/month/year)

20 August 1999 (20.08.99)

International application No.

PCT/SE98/01931

Applicant's or agent's file reference

Case 633 PCT

International filing date (day/month/year)

27 October 1998 (27.10.98)

Priority date (day/month/year)

03 November 1997 (03.11.97)

Applicant

BAHLENBERG, Gunnar et al

1. The designated Office is hereby notified of its election made:



in the demand filed with the International Preliminary Examining Authority on:

02 June 1999 (02.06.99)



in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was



was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer

Catherine Massetti

Telephone No.: (41-22) 338.83.38

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 98/01931

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: H04B 3/23

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: H04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 3804332 A1 (ANT NACHRICHTENTECHNIK GMBH), 24 August 1989 (24.08.89), column 1, line 9 - line 52, figure 1	1
A	--	2-7
X	US 5633863 A (PETER GYSEL ET AL), 27 May 1997 (27.05.97), figure 3, abstract	1
A	--	2-7
X	US 5479503 A (GEN'ICHI FUJIWARA), 26 December 1995 (26.12.95), figure 1, abstract	1
A	--	2-7



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"I" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

16 April 1999

Date of mailing of the international search report

19 -04- 1999

Name and mailing address of the ISA/

Swedish Patent Office

Box 5055, S-102 42 STOCKHOLM

Facsimile No. +46 8 666 02 86

Authorized officer

Rune Bengtsson

Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT
Information on patent family members

02/03/99

International application No.
PCT/SE 98/01931

Patent document cited in search report			Publication date	Patent family member(s)			Publication date
DE	3804332	A1	24/08/89	NONE			
<hr/>							
US	5633863	A	27/05/97	EP	0691756 A	10/01/96	
				IL	114493 A	30/10/98	
				NO	952670 A	08/01/96	
<hr/>							
US	5479503	A	26/12/95	JP	6069834 A	11/03/94	
<hr/>							

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference Case 633 PCT	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/SE98/01931	International filing date (day/month/year) 27.10.1998	Priority date (day/month/year) 03.11.1997
International Patent Classification (IPC) or national classification and IPC ₇ H 04 B 3/23		
Applicant Telia AB (publ) et al		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 3 sheets, including this cover sheet.

☒ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 2 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand 02.06.1999	Date of completion of this report 26.01.2000
Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. 08-667 72 88	Authorized officer Rune Bengtsson/MN Telephone No. 08-782 25 00

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/SE98/01931

I. Basis of the report

1. This report has been drawn on the basis of *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.)*:

☐ the international application as originally filed.

☒ the description, pages 1-5, as originally filed,
 pages _____, filed with the demand,
 pages _____, filed with the letter of _____,
 pages _____, filed with the letter of _____.

☒ the claims, Nos. _____, as originally filed,
 Nos. _____, as amended under Article 19,
 Nos. _____, filed with the demand,
 Nos. 1-5, filed with the letter of 12.01.2000,
 Nos. _____, filed with the letter of _____.

☒ the drawings, sheets/fig 1, as originally filed,
 sheets/fig _____, filed with the demand
 sheets/fig _____, filed with the letter of _____,
 sheets/fig _____, filed with the letter of _____.

2. The amendments have resulted in the cancellation of:

☐ the description, pages _____
☐ the claims, Nos. _____
☐ the drawings, sheets/fig _____

3. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the supplemental Box (Rule 70.2(c)).

4. Additional observations, if necessary:

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/SE98/01931

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	<u>1-5</u>	YES
	Claims		NO
Inventive step (IS)	Claims	<u>1-5</u>	YES
	Claims		NO
Industrial applicability (IA)	Claims	<u>1-5</u>	YES
	Claims		NO

2. Citations and explanations

D1: DE 3804332 A1

D2: US 5633863 A

D3: US 5479503 A

The amended claims 1-5 relate to a hybrid circuit including a filter in the receive path to reduce echo effects.

The claims differ from the state-of-the-art technology, as represented by D1-D3, in that the hybrid circuit is adapted to operate with a transmission system employing FDD at low frequencies and OFDD at high frequencies.

The requirements of novelty, inventive step and industrial applicability are fulfilled.

12-01-2000

CLAIMS

5 1. A hybrid circuit having a balanced 2-wire to 4-wire hybrid for interconnecting a two wire receive path and a two wire transmit path to a two wire transmission line, said two wire receive path connecting the balanced hybrid to an A/D convertor and said two wire transmit path connecting a D/A convertor to said balanced hybrid, and said two wire receive path contains a filter, characterised in that said hybrid circuit is adapted to operate with a transmission system employing FDD at low freequences, and said filter is dimensioned to reject transmit signals originating from said D/A convertor, that said hybrid circuit is adapted to operate with a transmission system employing OFDD at high freequences, and in that said filter is dimensioned to reject transmit sub-carriers originating from said D/A convertor.

15 2. A hybrid circuit as claimed in claim 1, characterised in that said hybrid circuit is adapted to operate with a duplex system having the following characteristics:

- 20
- all transmitters in ONUs and NTs in said duplex system are time synchronised;
 - timing advance is calculated from line lengths;
 - 25 different sub-carriers are employed for up-stream and down-stream transmissions;
 - a cyclic prefix is added to compensate for delay propagation in transmission lines; and
 - 30 frequencies above the FDD band are not employed for longer lines.

35 3. A hybrid circuit as claimed in claim 2, characterised in that said cyclic prefix is dimensioned for lines of length X metres and OFDD is used for lines shorter than X metres.

12-01-2000

4. A hybrid circuit, as claimed in either claim 2, or 3, characterised in that said balanced hybrid and said filter, together, introduce a delay less than a delay for which said cyclic prefix is dimensioned.

5

5. A duplex transmission system, characterised in that said duplex transmission system includes a plurality of hybrid circuits as claimed in any of claims 1 to 4.

PCT

From the INTERNATIONAL BUREAU

NOTICE INFORMING THE APPLICANT OF THE
COMMUNICATION OF THE INTERNATIONAL
APPLICATION TO THE DESIGNATED OFFICES

(PCT Rule 47.1(c), first sentence)

To:

PRAGSTEN, Rolf
Telia Research AB
Vitsandsgatan 9
S-123 86 Farsta
SUÈDEInkom Kgp
Telia Research AB

1999 -05- 2 5

Date of mailing (day/month/year)

14 May 1999 (14.05.99)

Applicant's or agent's file reference

Case 633 PCT

IMPORTANT NOTICE

International application No.

PCT/SE98/01931

International filing date (day/month/year)

27 October 1998 (27.10.98)

Priority date (day/month/year)

03 November 1997 (03.11.97)

Applicant

TELIA AB (publ) et al

1. Notice is hereby given that the International Bureau has communicated, as provided in Article 20, the international application to the following designated Offices on the date indicated above as the date of mailing of this Notice:
EP,JP,US

In accordance with Rule 47.1(c), third sentence, those Offices will accept the present Notice as conclusive evidence that the communication of the international application has duly taken place on the date of mailing indicated above and no copy of the international application is required to be furnished by the applicant to the designated Office(s).

2. The following designated Offices have waived the requirement for such a communication at this time:
EE,LT,LV,NO

The communication will be made to those Offices only upon their request. Furthermore, those Offices do not require the applicant to furnish a copy of the international application (Rule 49.1(a-bis)).

3. Enclosed with this Notice is a copy of the international application as published by the International Bureau on
14 May 1999 (14.05.99) under No. WO 99/23763

REMINDER REGARDING CHAPTER II (Article 31(2)(a) and Rule 54.2)

If the applicant wishes to postpone entry into the national phase until 30 months (or later in some Offices) from the priority date, a demand for international preliminary examination must be filed with the competent International Preliminary Examining Authority before the expiration of 19 months from the priority date.

It is the applicant's sole responsibility to monitor the 19-month time limit.

Note that only an applicant who is a national or resident of a PCT Contracting State which is bound by Chapter II has the right to file a demand for international preliminary examination.

REMINDER REGARDING ENTRY INTO THE NATIONAL PHASE (Article 22 or 39(1))

If the applicant wishes to proceed with the international application in the national phase, he must, within 20 months or 30 months, or later in some Offices, perform the acts referred to therein before each designated or elected Office.

For further important information on the time limits and acts to be performed for entering the national phase, see the Annex to Form PCT/IB/301 (Notification of Receipt of Record Copy) and Volume II of the PCT Applicant's Guide.

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No. (41-22) 740.14.35

Authorized officer

J. Zahra

Telephone No. (41-22) 338.83.38

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference Case 633 PCT	<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> FOR FURTHER ACTION </div> <div style="width: 50%; font-size: small;"> see Notification of Transmittal of International Search Report (Form PCT/ISA 220) as well as, where applicable, item 5 below. </div> </div>	
International application No. PCT/SE 98/01931	International filing date (<i>day month year</i>) 27 October 1998	(Earliest) Priority Date (<i>day month year</i>) 3 November 1997
Applicant Telia AB (publ) et al		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 2 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

1. ☐ Certain claims were found unsearchable (See Box I).

2. ☐ Unity of invention is lacking (See Box II).

3. ☐ The international application contains disclosure of a nucleotide and/or amino acid sequence listing and the international search was carried out on the basis of the sequence listing

☐ filed with the international application.
☐ furnished by the applicant separately from the international application.

☐ but not accompanied by a statement to the effect that it did not include matter going beyond the disclosure in the international application as filed.

☐ transcribed by this Authority.

4. With regard to the title, ☒ the text is approved as submitted by the applicant.
☐ the text has been established by this Authority to read as follows:

5. With regard to the abstract,

☒ the text is approved as submitted by the applicant.
☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the drawings to be published with the abstract is:
 Figure No. 1

☒ as suggested by the applicant.
☐ because the applicant failed to suggest a figure.
☐ because this figure better characterizes the invention.

☐ None of the figures.

INTERNATIONAL SEARCH REPORT

1

International application No.

PCT/SE 98/01931

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: H04B 3/23

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: H04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 3804332 A1 (ANT NACHRICHTENTECHNIK GMBH), 24 August 1989 (24.08.89), column 1, line 9 - line 52, figure 1	1
A	--	2-7
X	US 5633863 A (PETER GYSEL ET AL), 27 May 1997 (27.05.97), figure 3, abstract	1
A	--	2-7
X	US 5479503 A (GEN'ICHI FUJIWARA), 26 December 1995 (26.12.95), figure 1, abstract	1
A	--	2-7

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"I" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

16 April 1999

Date of mailing of the international search report

19 -04- 1999

Name and mailing address of the ISA

Swedish Patent Office
Box 5055, S-102 42 STOCKHOLM

Facsimile No. +46 8 666 02 86

Authorized officer

Rune Bengtsson

Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT
Information on patent family members

02/03/99

International application No.
PCT/SE 98/01931

Patent document cited in search report			Publication date	Patent family member(s)	Publication date
DE	3804332	A1	24/08/89	NONE	
US	5633863	A	27/05/97	EP 0691756 A IL 114493 A NO 952670 A	10/01/96 30/10/98 08/01/96
US	5479503	A	26/12/95	JP 6069834 A	11/03/94

PCT COOPERATION TREATY

PCT

NOTIFICATION CONCERNING
SUBMISSION OR TRANSMITTAL
OF PRIORITY DOCUMENT

(PCT Administrative Instructions, Section 411)

From the INTERNATIONAL BUREAU

To:

PRAGSTEN, Rolf
Telia Research AB
Vitsandsgatan 9
S-123 86 Farsta
SUÈDEInkom Kgp
Telia Research AB

1998-12-30

Date of mailing (day/month/year) 18 December 1998 (18.12.98)	
Applicant's or agent's file reference Case 633 PCT	IMPORTANT NOTIFICATION
International application No. PCT/SE98/01931	International filing date (day/month/year) 27 October 1998 (27.10.98)
International publication date (day/month/year) Not yet published	Priority date (day/month/year) 03 November 1997 (03.11.97)
Applicant TELIA AB (publ) et al	

1. The applicant is hereby notified of the date of receipt (except where the letters "NR" appear in the right-hand column) by the International Bureau of the priority document(s) relating to the earlier application(s) indicated below. Unless otherwise indicated by an asterisk appearing next to a date of receipt, or by the letters "NR" in the right-hand column, the priority document concerned was submitted or transmitted to the International Bureau in compliance with Rule 17.1(a) or (b).
2. This updates and replaces any previously issued notification concerning submission or transmittal of priority documents.
3. An asterisk(*) appearing next to a date of receipt, in the right-hand column, denotes a priority document submitted or transmitted to the International Bureau but not in compliance with Rule 17.1(a) or (b). In such a case, the attention of the applicant is directed to Rule 17.1(c) which provides that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity, upon entry into the national phase, to furnish the priority document within a time limit which is reasonable under the circumstances.
4. The letters "NR" appearing in the right-hand column denote a priority document which was not received by the International Bureau or which the applicant did not request the receiving Office to prepare and transmit to the International Bureau, as provided by Rule 17.1(a) or (b), respectively. In such a case, the attention of the applicant is directed to Rule 17.1(c) which provides that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity, upon entry into the national phase, to furnish the priority document within a time limit which is reasonable under the circumstances.

<u>Priority date</u>	<u>Priority application No.</u>	<u>Country or regional Office or PCT receiving Office</u>	<u>Date of receipt of priority document</u>
03 Nove 1997 (03.11.97)	9704010-9	SE	10 Dece 1998 (10.12.98)

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No. (41-22) 740.14.35

Authorized officer

Juan Cruz

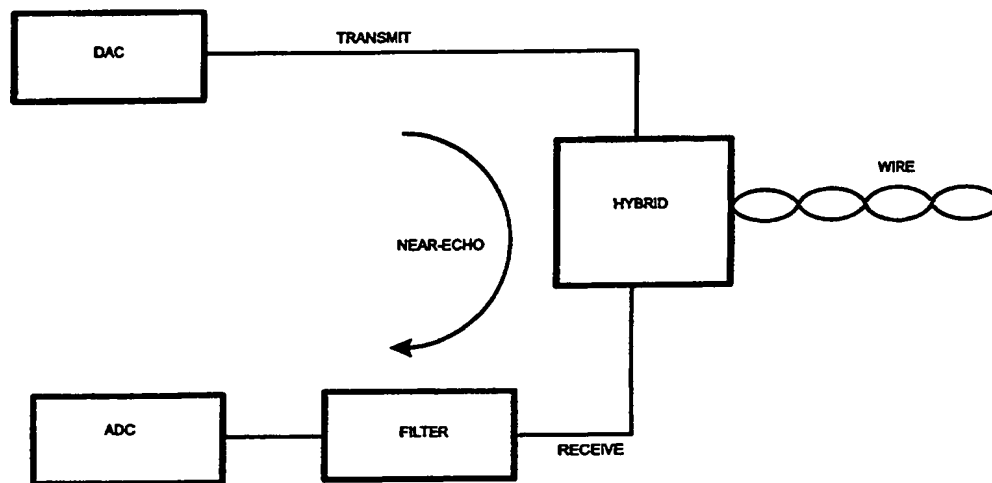
Telephone No. (41-22) 338.83.38



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁶ : H04B 3/23		A1	(11) International Publication Number: WO 99/23763
			(43) International Publication Date: 14 May 1999 (14.05.99)
(21) International Application Number: PCT/SE98/01931		<p>S-973 31 Luleå (SE). OLOFSSON, Sven-Rune [SE/SE]; Malmuddsvägen 9, S-972 46 Luleå (SE). STEFANSSON, Tomas [SE/SE]; Lulavan 773, S-961 93 Boden (SE). ÖMAN, Hans [SE/SE]; Fältspatstigen 21, S-977 53 Luleå (SE). ÖKVIST, Göran [SE/SE]; Hagaplan 7, S-974 41 Luleå (SE). ÖDLING, Per [SE/SE]; Professorsvägen 109 B, S-977 51 Luleå (SE). DENTGEN, Petra [SE/SE]; Docentvägen 141, S-977 52 Luleå (SE). SJÖBERG, Franck [SE/SE]; Forskarvägen 31 A, S-977 53 Luleå (SE).</p> <p>(74) Agent: PRAGSTEN, Rolf; Telia Research AB, Vitsandsgatan 9, S-123 86 Farsta (SE).</p> <p>(81) Designated States: EE, JP, LT, LV, NO, US, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).</p> <p>Published With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</p>	
(22) International Filing Date: 27 October 1998 (27.10.98)			
(30) Priority Data: 9704010-9 3 November 1997 (03.11.97) SE			
(71) Applicant (for all designated States except US): TELIA AB (publ) [SE/SE]; Mårbackagatan 11, S-123 86 Farsta (SE).			
(72) Inventors; and (75) Inventors/Applicants (for US only): BAHLENBERG, Gunnar [SE/SE]; Blidvägen 234, S-976 32 Luleå (SE). BENGTS-SON, Daniel [SE/SE]; Forskarvägen 36 A, S-977 53 Luleå (SE). HÅKANSSON, Siwert [SE/SE]; Aprilvägen 10, S-177 61 Järfälla (SE). ISAKSSON, Anders [SE/SE]; Elefvägen 1, S-977 25 Luleå (SE). ISAKSSON, Lars-Åke [SE/SE]; Res- idensgatan 6 C, S-972 36 Luleå (SE). ISAKSSON, Mikael [SE/SE]; Borgmästarevägen 7, S-973 42 Luleå (SE). JO- HANSSON, Magnus [SE/SE]; Timmermansgatan 34, S-972 51 Luleå (SE). LAHTI, Mauritz [SE/SE]; Lingonstigen 63, S-973 33 Luleå (SE). LJUNGGREN, Lis-Marie [SE/SE]; Praktikantvägen 31, S-977 53 Luleå (SE). LUNDBERG, Hans [SE/SE]; Västra Solgatan 8, S-972 53 Luleå (SE). NORDSTRÖM, Tomas [SE/SE]; Docentvägen 279, S-955 52 Luleå (SE). OLSSON, Lennart [SE/SE]; Majvägen 39,			

(54) Title: IMPROVEMENTS IN, OR RELATING TO, NEAR-ECHO SUPPRESSION



(57) Abstract

The present invention is a hybrid circuit which can be used to substantially reduce near echo signals. The circuit includes a balanced 2-wire to 4-wire hybrid for interconnecting a two wire receive path and a two wire transmit path to a two wire transmission line. The two wire receive path connects the balanced hybrid to an A/D convertor and the two wire transmit path connects a D/A convertor to the balanced hybrid. The two wire receive path contains a filter, dimensioned to remove signals transmitted from the D/A convertor. The invention is particularly adapted for use with FDD and OFDD.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece	ML	Mali	TR	Turkey
BG	Bulgaria	HU	Hungary	MN	Mongolia	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MR	Mauritania	UA	Ukraine
BR	Brazil	IL	Israel	MW	Malawi	UG	Uganda
BY	Belarus	IS	Iceland	MX	Mexico	US	United States of America
CA	Canada	IT	Italy	NE	Niger	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NL	Netherlands	VN	Viet Nam
CG	Congo	KE	Kenya	NO	Norway	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NZ	New Zealand	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	PL	Poland		
CM	Cameroon	KR	Republic of Korea	PT	Portugal		
CN	China	KZ	Kazakhstan	RO	Romania		
CU	Cuba	LC	Saint Lucia	RU	Russian Federation		
CZ	Czech Republic	LI	Liechtenstein	SD	Sudan		
DE	Germany	LK	Sri Lanka	SE	Sweden		
DK	Denmark	LR	Liberia	SG	Singapore		
EE	Estonia						

CLAIMS

1. A hybrid circuit having a balanced 2-wire to 4-wire hybrid for interconnecting a two wire receive path and a two wire transmit path to a two wire transmission line, said two wire receive path connecting the balanced hybrid to an A/D convertor and said two wire transmit path connecting a D/A convertor to said balanced hybrid, characterised in that said two wire receive path contains a filter.

2. A hybrid circuit, as claimed in claim 1, characterised in that said hybrid circuit is adapted to operate with a transmission system employing FDD, and in that said filter is dimensioned to reject transmit signals originating from said D/A convertor.

3. A hybrid circuit, as claimed in either claim 1, or claim 2, characterised in that said hybrid circuit is adapted to operate with a transmission system employing OFDD, and in that said filter is dimensioned to reject transmit sub-carriers originating from said D/A convertor.

4. A hybrid circuit as claimed in any previous claim, characterised in that said hybrid circuit is adapted to operate with a duplex system having the following characteristics:

- all transmitters in ONUs and NTs in said duplex system are time synchronised;
- timing advance is calculated from line lengths;
- different sub-carriers are employed for up-stream and down-stream transmissions;
- a cyclic prefix is added to compensate for delay propagation in transmission lines; and
- frequencies above the FDD band are not employed for longer lines.

- 7 -

5. A hybrid circuit as claimed in claim 4, characterised in that said cyclic prefix is dimensioned for lines of length X metres and OFDD is used for lines shorter than X metres.

6. A hybrid circuit, as claimed in either claim 4, or 5, characterised in that said balanced hybrid and said filter, together, introduce a delay less than a delay for which said cyclic prefix is dimensioned.

7. A duplex transmission system, characterised in that said duplex transmission system includes a plurality of hybrid circuits as claimed in any of claims 1 to 6.